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AN ANOMALOUS CASE OF SIMPLE REACTION

By E. B. TITCHENER

In their study of the effect of auditory distraction upon the sensory reaction, Cassel and Dallenbach mention an observer, *L*, who proved unable, under the instructions given for the practice-series, to maintain the required constancy of attitude.¹ *L*'s average for 100 'sensory reactions' taken near the beginning of the period of practice is $297.29 \pm 59.46 \sigma$, and her average for another 100, after more than 1,500 have been taken, is 284.47 ± 43.27 . It is plain that the m. v. is too large. It is plain also, however, that the times themselves are exceptional. They might serve as typical of sensory reaction to light; they are too long for sensory reaction to sound.

Since anomalous cases are often instructive, I thought it worth while to put the observer to a further test. *L* generously consented to sacrifice her spring vacation for the purpose; and Dr. Josephine Gleason, instructor in the department of psychology, was good enough to reassemble the apparatus and controls used by Cassel and Dallenbach, and to serve as experimenter. Since *L*'s vacation did not fall at the same time as our own—spring vacations are the free-lances of the academic calendar—we were unable to carry out our entire plan; in particular, we were unable to take reaction-times in other sense-departments.

With two exceptions, the experimental arrangements were identical with those of Cassel and Dallenbach. (1) We did not give our instructions for the three forms of simple reaction (sensory, natural, motor) by word of mouth, but type-wrote the formulas² and laid them, without comment or discussion, before the observer. We hoped in this way to further constancy of attitude. (2) The preparatory signals, which in the original experiment lasted nearly three-quarters of a second,³ were (at the observer's request) cut down to bare flashes of light.

The various series were distributed, as fairly as possible, over the hours at our disposal. We began with a preliminary series of 82 sensory reactions: the result was $298.97 \pm 56.73 \sigma$,

¹ This JOURNAL, xxix., 1918, 131 f.

² See my *Text-book of Psychology*, 1910, 436.

³ E. E. Cassel and K. M. Dallenbach, *op. cit.*, 131.

—figures that are sensibly the same as those quoted for their early 100 by Cassel and Dallenbach. The main experiment resulted as follows:

	No. expts.	No. sittings	Average
Sensory reaction	500	5	325.84 \pm 44.82
Natural reaction	500	6	277.25 \pm 26.31
Motor reaction	700	7	251.50 \pm 25.13

Three final series of 50, taken at a single sitting, gave:

Sensory reaction	306.28 \pm 36.70
Natural reaction	295.42 \pm 20.72
Motor reaction	227.18 \pm 14.07

In several respects these results are apparently normal. (1) The three forms of reaction show the regular time-order; the sensory times are longest, the motor times shortest. (2) The difference between sensory and motor reaction is 70-80 σ . (3) The m. v. of the natural and motor times is one-tenth (or less) of the times themselves. (4) The stabilising effect of practice appears in the lessened variation of the three final series.⁴

We note, on the other hand, (5) that the m. v. of the sensory reaction—although it is relatively smaller than that quoted for their concluding series by Cassel and Dallenbach, and although in our own final series it seems to be approaching the norm—is in the average too high. It is useless to guess what further experiments would have revealed; the pity is that we had no time to make them. We can say only that *if* the effect of practice had been continued, another 200 or 300 experiments would have brought the m. v. down to the required one-tenth of the total reaction-time. We note, also, (6) that the total times are all very much too high. This point needs fuller discussion,—and its discussion, we may premise, will force us to reject some of our previous conclusions regarding the normality of *L*'s results.

Let us, first of all, take *L*'s testimony as to her understanding of the instructions. In the case of the motor reaction she reports: "I was quite cautious not to react before I heard the particular sound. That had happened in the previous experiment [of Cassel and Dallenbach], and I had been warned against premature reaction. I 'identified' the stimulus, and I am positive that I should not have 'gone off' to any other sound." Again: "in the sensory reaction I was more careful

⁴ I attribute this decrease of the m. v. to practice because it appears in the successive series of the 'sensory' and 'motor' (though not in those of the natural) reactions. If there was any increase of attention due to *L*'s 'pulling herself together' for the final series,—and we have no evidence that there was,—it was probably offset by fatigue.

than ever. I waited to be really conscious of the stimulus. I waited with the intent to hear the sound and *know* it. That process seemed to be a hearing of the sound, and then a saying to myself 'This is the sound: react.' *Then* I reacted." There can be little doubt, therefore, that *L*'s 'motor' reaction is essentially a sensory reaction; and the times agree, since the norm of sensory reaction to sound is some 225σ . There can be little doubt, either, that *L*'s 'sensory' reaction is essentially a cognitive reaction. Here we have no means of direct comparison of times. But my own experiments upon the visual cognitive reaction to colors, short words, and letters gave times ranging from 290 to 320σ with m. v. of 24 to 39σ .⁵ It is true that there is a difference of sense-department, and it is true that *L* was not reacting under the external conditions of the experiment upon cognitive reaction. I think, nevertheless, that the agreement is as close as could have been expected.

So far, then, everything seems clear. Yet the question of attitude remains. How does it come about that *L* reacts in the sensory attitude to motor instructions, and in the cognitive attitude to sensory instructions? Moreover, the times of her natural reaction are to be considered. In the natural reaction, she says, "I more or less let myself go. I did not hold myself in tension, and reacted as the sound came to me, without any particular effort either to react quickly or to be careful concerning the identification of the stimulus as such." Yet the times lie between sensory and cognitive times, not between motor and sensory.

Here we may be in presence of a constitutional factor. *L* remarks: "I am extremely slow in games, and have never been proficient in any. It seems sometimes as if there were a definite effort necessary to connect the impulse to move with the action. Of course, this does not occur always; but it is very noticeable when I am trying to give my best attention to learn a game or a difficult gymnasium exercise. I can always remember it, even when I played games down at the district school." She says further: "I am naturally slow to react to auditory stimuli. In everyday experience I have always found it easier to get an idea by visual means than by auditory, that is, I can get an idea more quickly from reading than from hearing the same thing in a lecture. I read faster than most people." It is, again, a pity that we had no time to take reactions to visual stimuli. Evidently, the situation will not become transparent until such experiments are made.

⁵ "Zur Chronometrie des Erkennungsactes," *Philos. Studien*, viii., 1893, 141 ff.

Meantime, we may interpret our results as follows. *L* was called upon by Cassel and Dallenbach to give sensory reactions to sound. The experiment was unfamiliar and difficult, and *L* desired, as she puts it, to 'prove herself steady.' She accordingly took the instructions for the sensory reaction as if they had been instructions for a cognitive reaction. Since, however, this mode of reaction was neither favoured by the external conditions of the experiment nor circumscribed by fitting instructions, her *m. v.* was unduly large.

When she came to us, she was oppressed by the thought of 'the dreadful results of last spring' and aware that she was to undergo a further test. We began, perhaps unfortunately, with a practice-series of 'sensory' reactions, and *L* carried over to them the attitude which she had taken with Cassel and Dallenbach. She speaks of a "habit of reaction, so fixed that each reaction is not separate but rather a following of a fixed course of action;" "I felt as if I had reacted so many times in a certain way that I had really formed a habit of reaction." This 'habit' is also responsible for the long times of the natural reaction, which meant for *L* simply a slight letting-down from the deliberate self-control of the 'sensory' (cognitive) reaction. The demands of the motor instruction—"react as soon as you hear it; react as quickly as possible"—produced a change of attitude, and lowered the times of reaction by the 70-80 σ which we noted above; but the change covered only the single step, from cognitive to sensory, and not the two steps from cognitive to motor reaction.

Whether *L* is constitutionally incapable of motor reaction to sound, or whether, after practice with visual reactions, she would be competent to this form of response, cannot be said. She herself believes that she is naturally 'a slow reactor,' but the belief might prove to be rooted in some accident of her early experience. I hope that we may be able later on to resume the study of her case.